Method to Consolidate Motion Capture Data and Create Working Database Script for Universal Data Access

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**Background**

- The Human Dynamics and Controls Lab (HDCL) conducts various experiments and studies relating to musculoskeletal biomechanics (Figure 1)
  - All data are collected using a 6-camera Vicon motion capture system, force plates, electromyography (EMG), or a combination; and all other required data or analyses may be calculated from these systems’ output
  - These experiments are primarily self-contained, meaning only the experiment investigators know where the data are stored and formatted, and how to use them for certain analyses

**Research Plan**

- Collect, re-run, and organize original raw data from multiple experiments and researchers into intuitively designed structure arrays
- Examine various database options to determine the best solution for the HDCL lab
- Create a versatile, searchable database script
- Design database documentation to allow users with no previous experiment knowledge to search and add-on to the database

**Research Results**

- MATLAB was determined to be the best solution for database creation since a majority of HDCL researchers analyze their data with it
  - MATLAB contains a built-in Database Toolbox, but due to its limitations, a custom database script was required
  - Experimental data were organized into MATLAB’s structure array format, which is searchable by the custom script
- The script uses UI inputs to seek through the structure arrays (e.g., marker positions, joint centers, center of masses, and joint angles, Figure 2)
- Users select and save only the data they are interested in
- Multiple informational ‘readme’ files were created for existing experiments, and templates were created for use in future experiments
- The database was structured in such a way that future experiments will be compatible by following simple guidelines

**Goals**

- Design a method to accurately sort raw and/or processed data
  - Develop a uniform standard for creating and organizing the data files so that data from future experiments may be easily inserted into the database
  - Implement a detailed documentation scheme to give additional information on the procedures, subjects, trials, etc. of the numerous HDCL experiments
- Construct a searchable database script capable of selecting and organizing user-defined subsets of experimental data
  - Develop an easy-to-use interface allowing researchers to quickly explore and choose data they require

**Fundamental Questions/Challenges**

- Determining which software program to use in the database development
- Developing a dynamic search script capable of handling all experiment data acquired in HDCL and able to select specific gait cycles within defined trials
- Discovering a way to eliminate bad or inaccurate data from the database or to inform the user which data are inaccurate

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Figure 1 - Motion capture subject (left), with marker location output (right)

Figure 2 – Data structure visualization

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**Future Tasks**

- In the future, more data could be added for each experiment, e.g., kinetic joint data to complement existing kinematics
- Normalized data of each of the above could be calculated so that separate trials, with differing time scales, may be easily compared
- In the future it would be advantageous if the database was already aware of the accurate and inaccurate data before prompting the user to select the data
  - This could be achieved by adding another file containing only the accurate data

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